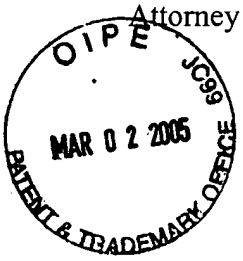
EXHIBIT F

Attorney Docket No.: 127976-1000 PATENT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application:	Tuy Vu Mai
Serial No.:	10/664,737
Filed:	September 18, 2003
Art Unit:	5612
Examiner:	Zanelli, Michael J.
Title:	**VEHICLE BASED DATA COLLECTION AND PROCESSING SYSTEM**

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO OFFICE ACTION MAILED DECEMBER 07, 2004

Dear Sir:

Applicant submits this response to the non-final Office action mailed December 07, 2004. In view of the following remarks, Applicant requests reconsideration of the pending claims.

Amendments to the specification begin on page 2 of this paper.

Amendment/Listing of the claims begins on page 7 of this paper, wherein Claims 1, 4, 15, and 16 are currently amended, and Claims 21 and 22 are new.

Amendments to the drawings begin on page 12 of this paper and include both an attached replacement sheet and an annotated sheet showing changes.

Remarks begin on page 16 of this paper.

An **Appendix** including amended drawing figures is attached following page 23 of this paper.

Amendments to the Specification

Please replace paragraph [0011] with the following amended paragraph:

[0011] For a better understanding of the invention, and to show by way of example how the same may be carried into effect, reference is now made to the detailed description of the invention along with the accompanying figures in which corresponding numerals in the different figures refer to corresponding parts and in which:

FIGURE 1 illustrates a vehicle based data collection and processing system of the present invention;

FIGURE 1A illustrates a portion of the vehicle based data collection and processing system of FIGURE 1;

FIGURE 1B illustrates a portion of the vehicle based data collection and processing system of FIGURE 1;

FIGURE 2 illustrates a vehicle based data collection and processing system of FIGURE 1 with the camera array assembly of the present invention shown in more detail;

FIGURE 3 illustrates a camera array assembly in accordance with certain aspects of the present invention;

FIGURE 4 illustrates one embodiment of an imaging pattern retrieved by the camera array assembly of Figure 1;

FIGURE 5 depicts an imaging pattern illustrating certain aspects of the present invention;

FIGURE 6 illustrates an image strip in accordance with the present invention;

FIGURE 7 illustrates another embodiment of an image strip in accordance with the present invention;

FIGURE 8 illustrates one embodiment of an imaging process in accordance with the present invention;

FIGURE 9 illustrates diagrammatically how photos taken with the camera array assembly can be aligned to make an individual frame;

FIGURE 10 is a block diagram of the processing logic according to certain embodiments of the present invention;

FIGURE 11 is an illustration of lateral oversampling looking down from a vehicle according to certain embodiments of the present invention;

FIGURE 12 is an illustration of lateral oversampling looking down from a vehicle according to certain embodiments of the present invention;

FIGURE 13 is an illustration of flight line oversampling looking down from a vehicle according to certain embodiments of the present invention;

FIGURE 14 is an illustration of flight line oversampling looking down from a vehicle according to certain embodiments of the present invention;

FIGURE 15 is an illustration of progressive magnification looking down from a vehicle according to certain embodiments of the present invention;

FIGURE 16 is an illustration of progressive magnification looking down from a vehicle according to certain embodiments of the present invention;

FIGURE 17 is an illustration of progressive magnification looking down from a vehicle according to certain embodiments of the present invention; and

FIGURE 18 is a schematic of the system architecture according to certain embodiments of the present invention.

Please replace paragraph [0013] with the following amended paragraph:

[0013] A vehicle based data collection and processing system 100 of the present invention is shown in ~~Figure 1~~ Figures 1, 1A, and 1B. Additional aspects and embodiments of the present invention are shown in Figures 2 and 18. System 100 includes one or more computer consoles 102. The computer consoles contain one or more computers 104 for controlling both vehicle and system operations. Examples of the functions of the computer console are the controlling digital color sensor systems that can be associated with the data collection and processing system, providing the display data to a pilot, coordinating the satellite generated GPS pulse-per-second (PPS) event trigger (which may be 20 or more pulses per second), data logging, sensor control and adjustment, checking and alarming for error events, recording and indexing photos, storing and processing data, flight planning capability that automates the navigation of the vehicle, data, and providing a real-time display of pertinent information. A communications interface between the control computer console and the vehicle autopilot control provides the ability to actually control the flight path of the vehicle in real-time. This results in a more precise control of the vehicle's path than is possible by a human being. All of these functions can be accomplished by the use of various computer programs that are synchronized to the GPS PPS signals and take into account the various electrical latencies of the measurement devices.

Please replace paragraph [0014] with the following amended paragraph:

[0014] One or more differential global positioning systems 106 are incorporated into the system 100. The global positioning systems 106 are used to navigate and determine precise ~~flights~~ flight paths during vehicle and system operations. To accomplish this, the global positioning systems 106 are communicatively linked to the computer console 102 such that the information from the global positioning systems 106 can be acquired and processed without

flight interruption. Zero or more GPS units may be located at known survey points in order to provide a record of each sub-seconds' GPS satellite-based errors in order to be able to back correct the accuracy of the system 100. GPS and/or ground based positioning services may be used that eliminate the need for ground control points altogether. This technique results in greatly improved, sub-second by sub-second positional accuracy of the data capture vehicle.

Please replace paragraph [0016] with the following amended paragraph:

[0016] One or more one ~~or more~~ camera array assemblies 112 for producing an image of a target viewed through an aperture are also communicatively connected to the one or more computer consoles 102. The camera array assemblies 112, which will be described in greater detail below, provide the data collection and processing system with the ability to capture high resolution, high precision progressive scan or line scan, color digital photography.

Please replace paragraph [0020] with the following amended paragraph:

[0020] A complete flight planning methodology is used to micro plan all aspects of missions. The inputs are the various mission parameters (latitude/longitude, resolution, color, accuracy, etc.) and the outputs are detailed on-line digital maps and data files that are stored onboard the data collection vehicle and used for real-time navigation and alarms. The ability to interface the flight planning data directly into the autopilot is an additional integrated capability. A computer program may be used that automatically controls the flight path, attitude adjustments, graphical display, moving maps of the vehicle path, checks for alarm conditions and corrective actions, notifies the pilot and/or crew of overall system status, and provides for fail-safe operations and controls. Safe operations parameters may be constantly monitored and reported. Whereas the current system uses a manned crew, the system is designed to perform equally ~~will~~ well in an unmanned vehicle.

Please replace paragraph [0023] with the following amended paragraph:

[0023] The system 100 may also use highly fault-tolerant methods that have been developed ~~that provides~~ to provide a software inter-leaved disk storage methodology that allows one or two hard drives to fail and still not lose target data that is stored on the drives. This

software inter-leaved disk storage methodology provides superior fault-tolerance and portability versus other, hardware methodologies, such as RAID-5.

Please replace paragraph [0034] with the following amended paragraph:

Referring now to ~~Figure 2~~ Figure 4, images of areas 336, 328, 326, 332 and 340 taken by cameras 306 through 314, respectively, are illustrated from an overhead view. Again, because of the "cross-eyed" arrangement, the image of area 336 is taken by camera 306, the image of area 340 is taken by camera 314, and so on. In one embodiment of the present invention, images other than those taken by the center camera 310 take on a trapezoidal shape after perspective transformation. Cameras 306 through 314 form an array along axis 316 that is, in most applications, pointed down vertically. In an alternative embodiment, a second array of cameras, configured similar the array of cameras 306 through 314, is aligned with respect to the first array of cameras to have an oblique view providing a "heads-up" perspective. The angle of declination from horizontal of the heads-up camera array assembly may vary due to mission objectives and parameters but angles of 25-45 degrees are typical. Other alternative embodiments, varying the mounting of camera arrays, are similarly comprehended by the present invention. In all such embodiments, the relative positions and attitudes of the cameras are precisely measured and calibrated so as to facilitate image processing in accordance with the present invention.

Please replace paragraph [0069] with the following amended paragraph:

[0069] Figure 9 illustrates diagrammatically how photos taken with the camera array assembly may be aligned to make an individual frame. This embodiment shows a photo pattern illustration looking down from the Aircraft, using data ortho-rectified from five cameras.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of the Claims

1. (Currently Amended) A system for generating a map of a surface, comprising:

a global position transmitter;

a vehicle, disposed over the surface;

an elevation measurement unit, secured to the vehicle;

a global positioning antenna, secured to the vehicle;

an attitude measurement unit, secured to the vehicle;

an imaging array, secured to the vehicle, comprising:

a housing;

an aperture, disposed in the housing, having an intersection area therein;

a first imaging sensor, coupled to the housing, having a first focal axis passing through the aperture within the intersection area, generating a first array of pixels; and

a second imaging sensor, coupled to the housing and offset from the first imaging sensor, having a second focal axis passing through the aperture and intersecting the first focal axis within the intersection area, generating a second array of pixels;

a computer, connected to the elevation measurement unit, the global positioning antenna, the attitude measurement unit and first and second imaging sensors; correlating at least a portion of the image data from the first and second imaging sensors to a portion of the surface based on input from one or more of: the elevation measurement unit, the global positioning antenna and the attitude measurement unit.

2. (Currently Amended) The system of claim 1 further comprising a third imaging sensor, coupled to the housing and offset from the first imaging sensor, having a ~~second~~ third focal axis passing through the aperture and intersecting the first focal axis within the intersection area.

3. (Original) The system of claim 2 wherein the focal axis of the third imaging sensor lies in a common plane with the focal axes of the first and second imaging sensors.

4. (Currently Amended) The system of claim 2 ~~wherein 2~~ wherein the focal axes of the first and second imaging sensors lie in a first common plane and the focal axis of the third imaging sensor lies in a plane orthogonal to the first common plane.

5. (Original) The system of claim 1 wherein the focal axis of the first imaging sensor is disposed vertically.

6. (Currently Amended) The system of claim 5 wherein the focal axis of the second imaging sensor is disposed in a first plane with, and at a first angle to, the focal axis of the first imaging sensor and a focal axis of a third imaging sensor is disposed opposite the second imaging sensor from the first imaging sensor in the first ~~common~~ plane and at a second angle having the same magnitude as the first angle.

7. (Original) The system of claim 6 further comprising fifth and sixth imaging sensors disposed on opposite sides of the first imaging sensor, having focal axes disposed in a second plane common with the focal axis of the first imaging sensor orthogonal to the first common plane and at third and fourth angles from the focal axis of the first imaging sensor having the same magnitude.

8. (Original) A system for generating a map of a surface, comprising:

a global position transmitter;

a vehicle, disposed over the surface;

an elevation measurement unit, secured to the vehicle;

a global positioning antenna, secured to the vehicle;

an attitude measurement unit, secured to the vehicle;

a first imaging sensor, secured to the vehicle, having a focal axis disposed in the direction of the surface, generating an image comprising an array of pixels;

a computer, connected to the elevation measurement unit, the global positioning antenna, the attitude measurement unit and the first imaging sensor; generating a calculated longitude and calculated latitude value for a coordinate corresponding to at least one pixel in the array based on input from one or more of: the elevation measurement unit, the global positioning antenna and the attitude measurement unit.

9. (Original) The system of claim 8 wherein the global position transmitter is satellite-based.

10. (Original) The system of claim 8 wherein the global position transmitter is ground-based.

11. (Original) The system of claim 8 wherein the elevation measurement is a LIDAR apparatus.

12. (Original) The system of claim 8 wherein the attitude measurement unit is a gyroscope.

13. (Original) The system of claim 8 wherein the focal axis of the first imaging sensor is vertical and passes through an aperture, and wherein the system further comprises:

a second imaging sensor, coupled to the vehicle and offset from the first imaging sensor, having a second focal axis passing through the aperture and intersecting the first focal axis within an intersection area, and

a third imaging sensor, coupled to the vehicle and offset from the first imaging sensor opposite the second imaging sensor, having a third focal axis passing through the aperture and intersecting the first focal axis within the intersection area.

14. (Original) The system of claim 13 wherein the vehicle has a direction vector, and wherein the focal axis of the second imaging sensor lies in a plane orthogonal to the direction vector of the vehicle.

15. (Currently Amended) A system for generating a map of a surface, comprising:

a global position transmitter;

a vehicle, disposed over the surface;

an elevation measurement unit, secured to the vehicle;

a global positioning antenna, secured to the vehicle;

an attitude measurement unit, secured to the vehicle;

an imaging array, secured to the vehicle, comprising:

a housing;

an aperture, disposed in the housing, having an intersection area therein;

a first imaging sensor, coupled to the housing, having a focal axis passing through the aperture within the intersection area, generating a first array of pixels; and

a second imaging sensor, coupled to the housing and offset from the first imaging sensor, having a second focal axis passing through the aperture and intersecting the first focal axis within the intersection area, generating a second array of pixels;

a computer, connected to one or more of: the elevation measurement unit, the global positioning antenna, the attitude measurement unit, the first imaging sensor and the second imaging sensor; <u>generating a mosaic from the first array of pixels and the second array of pixels;</u>

calculating the true longitude and true latitude of at least one point on the surface corresponding to at least one pixel in the ~~array~~ mosaic based on the input from one or more of: the elevation measurement unit, the global positioning antenna and the attitude measurement unit.

16. (Currently Amended) The system of claim 15 wherein further comprising a third imaging sensor, coupled to the housing and offset from the first imaging sensor, having a ~~second~~ third focal axis passing through the aperture and intersecting the first focal axis within the intersection area.

17. (Original) The system of claim 16 wherein the focal axis of the third imaging sensor lies in a common plane with the focal axes of the first and second imaging sensors.

18. (Original) The system of claim 16 wherein the focal axes of the first and second imaging sensors lie in a first common plane and the focal axis of the third imaging sensor lies in a plane orthogonal to the first common plane.

19. (Original) The system of claim 16 wherein the focal axis of the third imaging sensor lies in a first common plane with the focal axes of the first and second imaging sensors and wherein the system further comprises a fourth imaging sensor having a focal axis lying in a plane orthogonal to the first common plane.

20. (Original) The system of claim 16 wherein the focal axis of the third imaging sensor lies in a first common plane with the focal axes of the first and second imaging sensors and the system further comprises fourth and fifth imaging sensors having focal axes lying in the first common plane and intersecting the focal axis of the first imaging sensor within the intersection area.

21. (New) The system of claim 2, wherein the second focal axis and the third focal axis are the same.

22. (New) The system of claim 16, wherein the second focal axis and the third focal axis are the same.

Amendments to the Drawings

The attached sheet of drawings includes changes to Figures 1-18. The sheet that includes Figure 1 now replaces the original sheet that included Figure 1. In Figure 1, the lines connecting and identifying certain representational components have been repositioned for reasons of clarity. In Figure 1, the shape of the boxes have been changed and repositioned for reasons of clarity and stylistic preference. Additionally, Applicant has deleted some of the words in Figure 1, without prejudice and for reasons of clarity. No new matter has been added to Figure 1. Additionally, the arrow pointing to the block previously labeled "main computer console" has been deleted. Accordingly, Applicant respectfully requests the withdrawal of the objection to Figure 1.

In this application, Applicant has added new Figure 1A. Support for new Figure 1A is in the portion to the right of the squiggly-drawn-in line in annotated Figure 1. No new matter has been added to the specification as originally filed by including new Figure 1A.

In this application, Applicant has added new Figure 1B. Support for new Figure 1B is in the portion to the left of the squiggly-drawn-in line in annotated Figure 1. No new matter has been added to the specification as originally filed by including new Figure 1B.

The sheets that includes Figure 2 now replaces the original sheet that included Figure 2. In Figure 2, the lines connecting and identifying certain representational components have been repositioned for reasons of clarity. No new matter has been added to Figure 2.

The sheets that includes Figures 3 and 4 now replaces the original sheet that included Figure 3 and the original sheet that included Figure 4. In Figures 3 and 4, the lines connecting

and identifying certain representational components have been repositioned for reasons of clarity. No new matter has been added to Figures 3 and 4.

The sheet that includes Figure 5 now replaces the original sheet that included Figure 5. In Figure 5, the lines identifying certain representational components have been repositioned for reasons of clarity. In Figure 5, element 513 has been added. Support for the addition of element 513 is found in paragraph 0051 of the specification as originally filed. Additionally, Applicant has deleted the words in Figure 5, without prejudice and for reasons of clarity. No new matter has been added to Figure 5.

The sheets that includes Figures 6 and 7 now replaces the original sheet that included Figure 6 and the original sheet that included Figure 7. In Figures 6 and 7, the lines identifying certain representational components have been repositioned for reasons of clarity. No new matter has been added to Figures 6 and 7.

The sheet that includes Figure 8 now replaces the original sheet that included Figure 8. In Figure 8, the lines identifying certain representational components have been repositioned for reasons of clarity. No new matter has been added to Figure 8.

The sheet that includes Figure 9 now replaces the original sheet that included Figure 9. In Figure 9, Applicant has deleted the title, without prejudice and for reasons of clarity. No new matter has been added to Figure 9.

The sheet that includes Figure 10 now replaces the original sheet that included Figure 10. In Figure 10, the lines connecting and identifying certain representational components have been repositioned for reasons of clarity. In Figure 10, the shape of the boxes have been changed and repositioned for reasons of clarity and stylistic preference. Additionally, Applicant has deleted

some of the words in Figure 10, without prejudice and for reasons of clarity. No new matter has been added to Figure 10.

The sheet that includes Figures 11, 12, and 13 now replaces the original sheet that included Figures 11 and 12, and that portion of the sheet that included Figure 13. In Figures 11, 12, and 13 the lines identifying certain representational components have been repositioned for reasons of clarity. In Figures 11, 12, and 13, the boxes have been repositioned for reasons of clarity and stylistic preference. Additionally, Applicant has deleted some of the words in Figures 11, 12, and 13 without prejudice and for reasons of clarity. No new matter has been added to Figures 11, 12 and 13.

The sheet that includes Figures 14, and 15 now replaces the original sheet that included the portion of the sheet that included Figure 14 and the portion of the sheet that included Figure 15. In Figures 14 and 15 the lines identifying certain representational components have been repositioned for reasons of clarity. In Figures 14 and 15, the shape of the boxes have been changed and repositioned for reasons of clarity and stylistic preference. Additionally, Applicant has deleted some of the words in Figures 14 and 15 without prejudice and for reasons of clarity. No new matter has been added to Figures 14 and 15.

The sheet that includes Figures 16 and 17 now replaces the original sheet that included the portion of the sheet that included Figures 16 and 17. In Figures 16 and 17 the lines identifying certain representational components have been repositioned for reasons of clarity. In Figures 16 and 17, the shape of the boxes have been changed and repositioned for reasons of clarity and stylistic preference. Additionally, Applicant has deleted some of the words in Figures 16 and 17 without prejudice and for reasons of clarity. No new matter has been added to Figures 16 and 17.

The sheet that includes Figure 18 now replaces the original sheet that included Figure 18. In Figure 18, the lines connecting and identifying certain representational components have been repositioned for reasons of clarity. In Figure 18, the shape of the boxes have been changed and repositioned for reasons of clarity and stylistic preference. Additionally, Applicant has deleted some of the words in Figure 18, without prejudice and for reasons of clarity. No new matter has been added to Figure 18.

Accordingly, Applicant respectfully requests withdrawal of the objection to the drawings filed on September 18, 2003.

Remarks

Applicant has cooperated with the Office Action's request that the lengthy specification be checked to determine the presence of possible minor errors. Accordingly, Applicant has amended paragraph numbers 14, 16, 20, and 23 merely for grammatically stylistic reasons, without prejudice. Paragraph 11 has been amended to accommodate new Figure 1A and new Figure 1B. The new figures are supported by Figure 1 as originally filed, no new matter has been added. Paragraph 13 has also been amended to accommodate new Figure 1A and new Figure 1B. The amendments to Paragraph 13 are supported by Figure 1 as originally filed, no new mater has been added. Paragraph 34 has been amended to correct the unintentional mistake of referring to Figure 2, when clearly referring to Figure 4. Support for the amendment is found in Figure 4 as originally filed. Additionally, Applicant has amended paragraph 69 to further explain Figure 9. Support for this amendment can be found in the title to Figure 9 as originally filed. Applicant respectfully asserts that no new matter has been added in these amendments to the specification.

In this application, Applicant has respectfully developed a novel system for rendering high-resolution, high accuracy, low distortion digital images over very large fields of view. In particular, independent Claim 1 is directed toward a system for generating a map of a surface, comprising: a global position transmitter; a vehicle, disposed over the surface; an elevation measurement unit, secured to the vehicle; a global positioning antenna, secured to the vehicle; an attitude measurement unit, secured to the vehicle; an imaging array, secured to the vehicle, comprising: a housing; an aperture, disposed in the housing, having an intersection area therein; a first imaging sensor, coupled to the housing, having a first focal axis passing through the aperture within the intersection area; and a second imaging sensor, coupled to the housing and

offset from the first imaging sensor, having a second focal axis passing through the aperture and intersecting the first focal axis within the intersection area; a computer, connected to the elevation measurement unit, the global positioning antenna, the attitude measurement unit and first and second imaging sensors; correlating at least a portion of the image data from the first and second imaging sensors to a portion of the surface based on input from one or more of: the elevation measurement unit, the global positioning antenna and the attitude measurement unit.

Claims 1-22 are currently pending in this application, wherein Claim 4 is object to; Claims 2-4, 6, 7, and 15-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite; Claims 1-20 are rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. 5,878,356 ("Garrot") in view of U.S. 2002/0060784 ("Pack") and U.S. 4,689,748 ("Hoffmann"); and Claims 21-22 are newly presented.

Informal Objection

Claim 4 has been amended to delete the extraneous "wherein 2" as requested in the Office Action. Applicant has added no new matter in correcting this minor informality. Accordingly, Applicant respectfully requests the objection to Claim 4 be withdrawn.

35 U.S.C. 112, second paragraph

Claim 2 has been amended to make clear that the third imaging sensor has a third focal axis passing through the aperture, which is in one embodiment different from the second focal axis. Applicant, however, has added Claim 21 to makes clear that in an alternative embodiment the second focal axis and the third focal axis can be the same. Support for the newly added

Claim 21 can be found in paragraph 0027, lines 7-10 of the specification. Support for the amendment to Claim 2 can be found in paragraph 8, lines 12-15 of the specification. No new matter has been added to Claims 2 or 21. Accordingly, Applicant respectfully requests the withdrawal of this rejection.

The Office Action states that Claim 4 lacks antecedent basis in the recitation of "the first common plane." Respectfully, however, Applicant asserts that Claim 4 as filed correctly recited "a first common plane" in line 2 of Claim 4, and then correctly recited "the first common plane" in line 3 of Claim 4. Applicant kindly requests that the Examiner contact the undersigned attorney via telephone at 713.276.5382 in the event the Examiner believes that Claim 4 as originally filed incorrectly recited "the first common plane." Accordingly, Applicant respectfully requests the withdrawal of this rejection.

Claim 6 has been amended to correct the antecedent basis—as requested in the Office Action—and make clear that the first plane in line 2 of Claim 6 is the same plane as the first plane in line 4 of Claim 6. Applicant makes this amendment without prejudice to merely comply with the generally acceptable lexicon of patent prosecution. No new matter has been added to Claim 6. Accordingly, Applicant respectfully requests the withdrawal of this rejection.

Claim 15 has been amended to make clear that the array mentioned in line 18 of Claim 15 referred to the mosaic generated from the first array of pixels and the second array of pixels. Support for the amendment can be found in paragraph 0035 and Claim 1 as originally filed. No new matter has been added to Claim 15. Accordingly, Applicant respectfully requests the withdrawal of this rejection.

Claim 16 has been amended to make clear that the third imaging sensor has a third focal axis passing through the aperture, which is in one embodiment different from the second focal axis. Applicant, however, has added Claim 22 to makes clear that in an alternative embodiment the second focal axis and the third focal axis can be the same. Support for the newly added Claim 22 can be found in paragraph 0027, lines 7-10 of the specification. Support for the amendment to Claim 16 can be found in paragraph 8, lines 12-15 of the specification. No new matter has been added to Claims 16 or 22. Accordingly, Applicant respectfully requests the withdrawal of this rejection.

Claims 3, 7, and 17-20 were rejected under 35 U.S.C. § 112, second paragraph as being dependent from a rejected base claim. In light of the above reasoning and amendments, Applicant respectfully requests the withdrawal of the rejection under 35 U.S.C. § 112 to Claims 3, 7, and 17-20.

35 U.S.C. § 103(a)

Applicant has amended independent Claim 1—and therefore its dependencies—to make clear that the first imaging sensor generates a first array of pixels and the second imaging sensor generates a second array of pixels. Support for the amendment is found in paragraph 0035 and in Claim 15 as originally filed.

Garrot is directed toward a system for generating thermal/infrared images of land that can be useful in agricultural applications. (Garrot Abs. and Col. 1, lines 12-14) In this manner, Garrot discloses an aircraft based imaging system for acquiring infrared signals and georeferencing the acquired signals. (Garrot, Abs.) The infrared imaging sensor disclosed in Garrot has a single lens and produces a multispectral-unidirectional line scan—in a manner

similar to a photocopier. As noted in the Office Action this technology is not comparable to the imaging array of Applicant's invention. Accordingly, the Office Action submits that it would have been obvious to one of ordinary skill to replace the sensor of Garrot with the device disclosed in Hoffman. Applicant respectfully asserts that this substitution is not obvious, and even if one were to use the device disclosed in Hoffman in place of the sensor disclosed in Garrot Applicant's claimed invention would be neither anticipated nor made obvious.

Hofmann discloses a device that consists of parallel rows of photosensitive semiconductor elements and a lens system. (Hoffman, Abs.) Hofmann characterizes its device as a 'stereo line scanner', and boasts that "it is now possible, in principle, to compute the relative orientation of this device or 'stereo line scanner' for each individual line scan period by causing the rays..." (Hoffman Col. 3, lines 39-46) Accordingly, Applicant's have amended their claims to more clearly define their imaging sensors. As amended, Applicant's claims require an imaging array, which comprises an imaging sensor that generates at least a first and second *array* of pixels—as opposed to a line scan. (emphasis added) A line scan sensor rapidly records successive images in rows of pixels—in a manner analogous to the way the light moves across a photocopier. In contrast to the line scan sensors disclosed in Garrot and Hofmann, Applicant's imaging sensors generate arrays of pixels. It was generally thought, prior to Applicant's disclosure that imaging sensors generating arrays would not produce high-resolution, high-accuracy, low-distortion digital images over very large fields of view. Moreover, Hofmann teaches that "if the scanning is done by an arrangement wherein each of the sensor lines has a different lens system assigned to it … nothing will basically change as far as this computational method is concerned", and therefore teaches away from using sensors that generate arrays. (Hoffman Col. 4, lines 24-29) Accordingly, nothing in Garrot, or Hofmann teaches or suggests

using an imaging sensor, which generates at least a first and second array of pixels in combination with Applicant's claimed system.

Pack discloses a system for generating georectified three dimensional images and topography. (Pack, Abs.) In this manner, Pack discloses the use of a LIDAR system to collect elevation data of a surface. (Pack, paragraph 0058) Pack also discloses the use of a digital camera to collect "passive spectral radiation". (Pack, paragraph 0057) Applicant respectfully asserts that Pack is using a digital camera to generate a visual reference, which is used to better orient the elevation surface data. In contrast, Applicant uses a digital camera as an integral part of a complex system directed toward mapping digital images. Nothing in Pack fairly suggests using a digital camera in a complex system to map digital images. In fact, Pack teaches away from using a digital camera in a complex system.

Pack discloses a system of producing "georectified three dimensional digital imagery in real time", without the "complex analytic equations..." (Pack Abs: Col 1, paragraph 0007) Applicant therefore asserts that as Pack teaches away from complex analytic equations, it would be an exercise in impermissible hindsight reconstruction—as well as a gross simplification of the art—to suggest one of ordinary skill in the art would have been motivated to substitute the digital camera disclosed in Pack for the imager disclosed in Garrot. Moreover, Applicant submits that even if one were to have made such an unlikely substitution they would not be able to make a working system without the use of complex analytic equations. There is simply no motivation to substitute a camera used to visually reference the elevation data of a LIDAR system for a camera used to collect thermal/infrared images of land. Therefore, Applicant respectfully asserts there is a lack of motivation to combine Pack and Garrot.

Alternatively, assuming—*arguendo*—one of ordinary did combine Pack and Garrot they would not arrive at Applicant's claimed invention as described in Claims 1-7 and 13-20. Specifically, Pack fails to fairly teach or suggest the presence of a second imaging sensor.

Applicant submits that the claims are novel and not made obvious by Garrot, Hofmann, Pack or their combination. Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 103(a) to Claims 1-20.

Finally, Applicant respectfully informs the Examiner that the subject matter of each claim was commonly owned at the time of invention.

Conclusion

In view of the foregoing remarks, Applicant respectfully submits that the application is now in condition for allowance, and respectfully requests issuance of a Notice of Allowance directed towards claims 1-22.

Should any fee be due in connection with the filing of this document the Commissioner for Patents is hereby authorized to deduct said fee from Deposit Account No. 07-1053.

Respectfully submitted,

Date: 3/2/05

Jennifer S. Sickler
Registration No. 36,005

Gardere Wynne Sewell LLP
1000 Louisiana, Suite 3400
Houston, Texas 77002-5007
(713) 276-5382 phone
(713) 276-6382 fax
jsickler@gardere.com

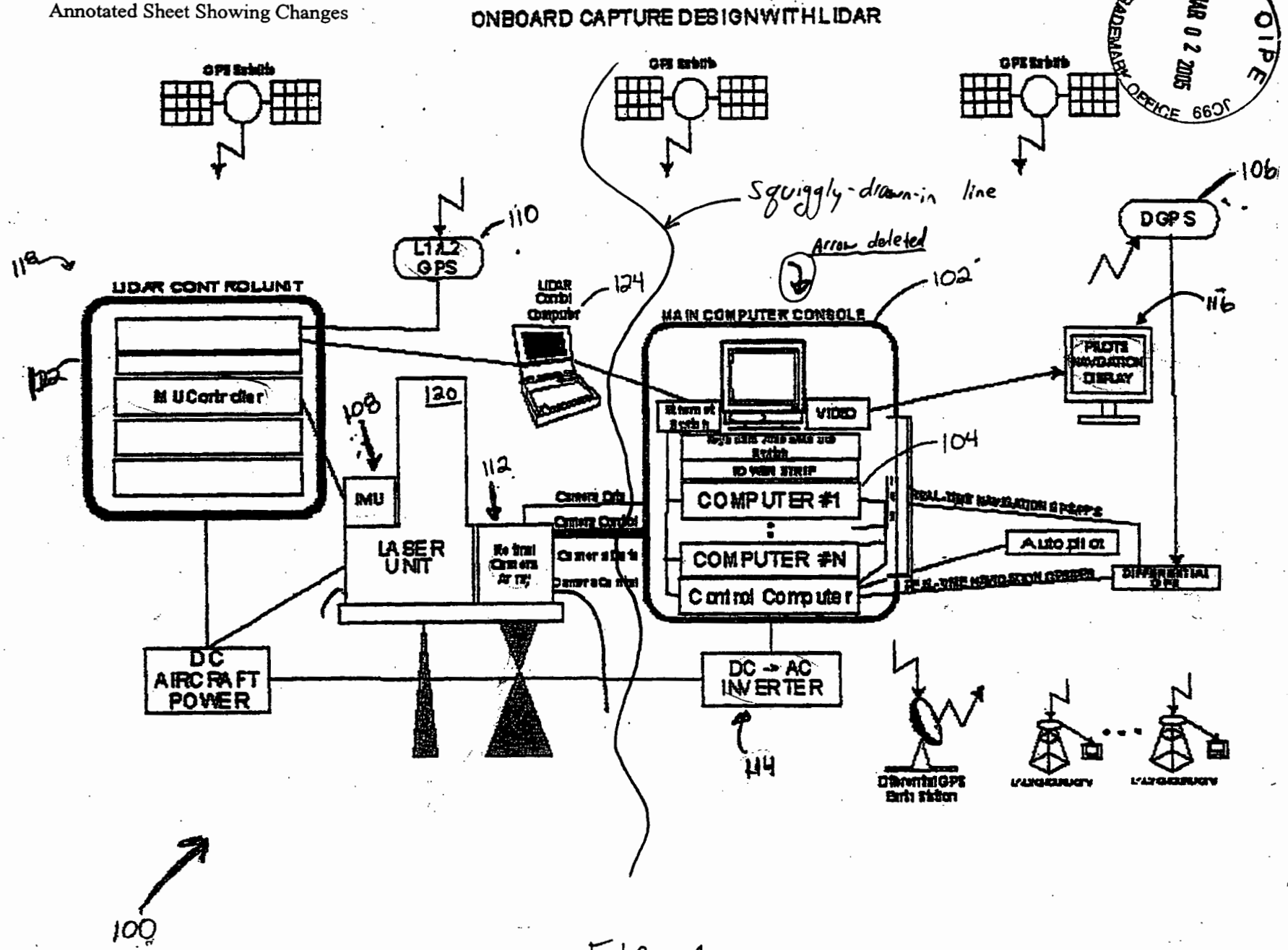


FIG. 1

ONBOARD CAPTURE DESIGN WITH ORTHO/STEREO RETINAL CAMERA ARRAY (ORCA)

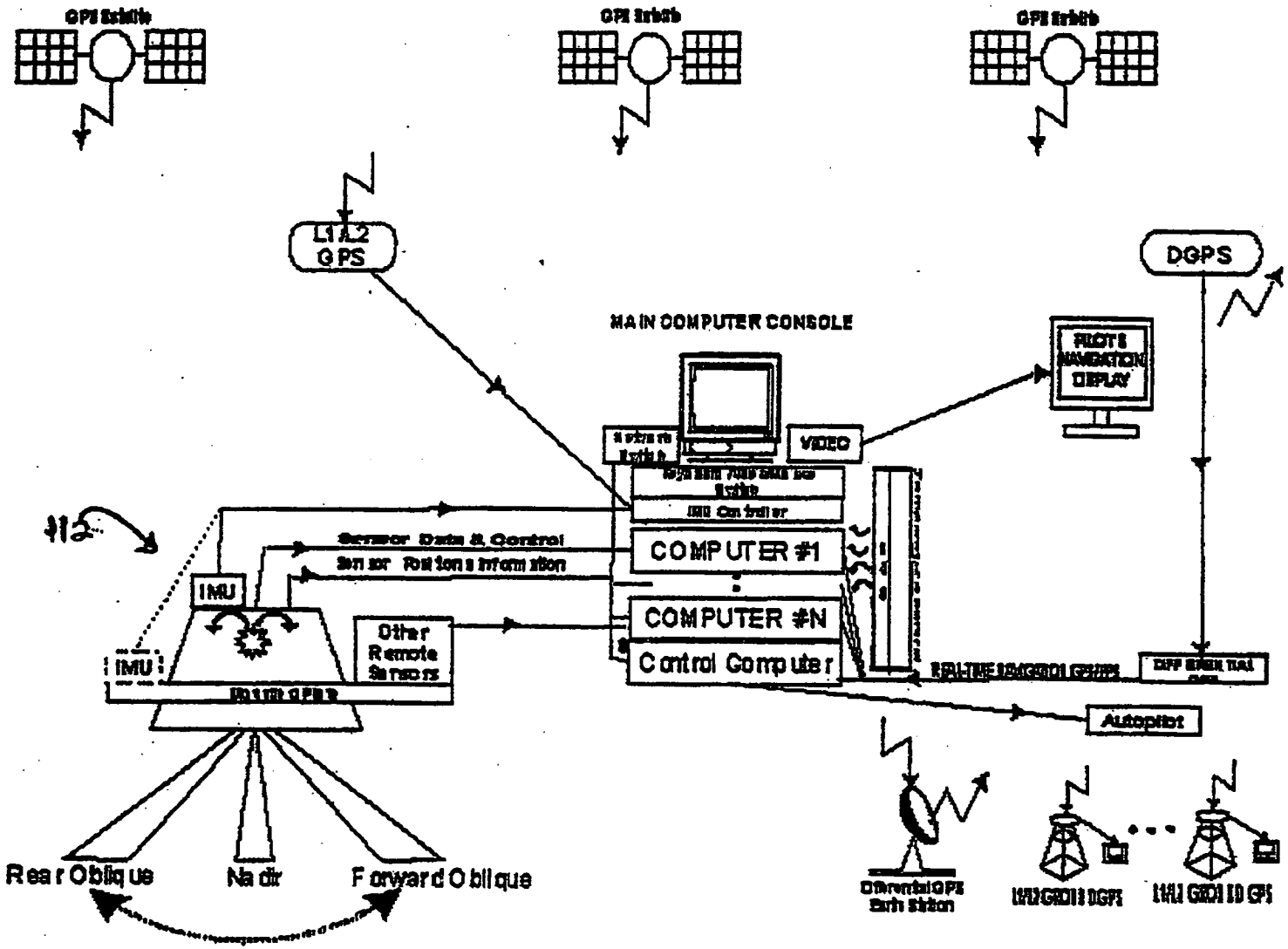


FIG. 2

BEST AVAILABLE COPY

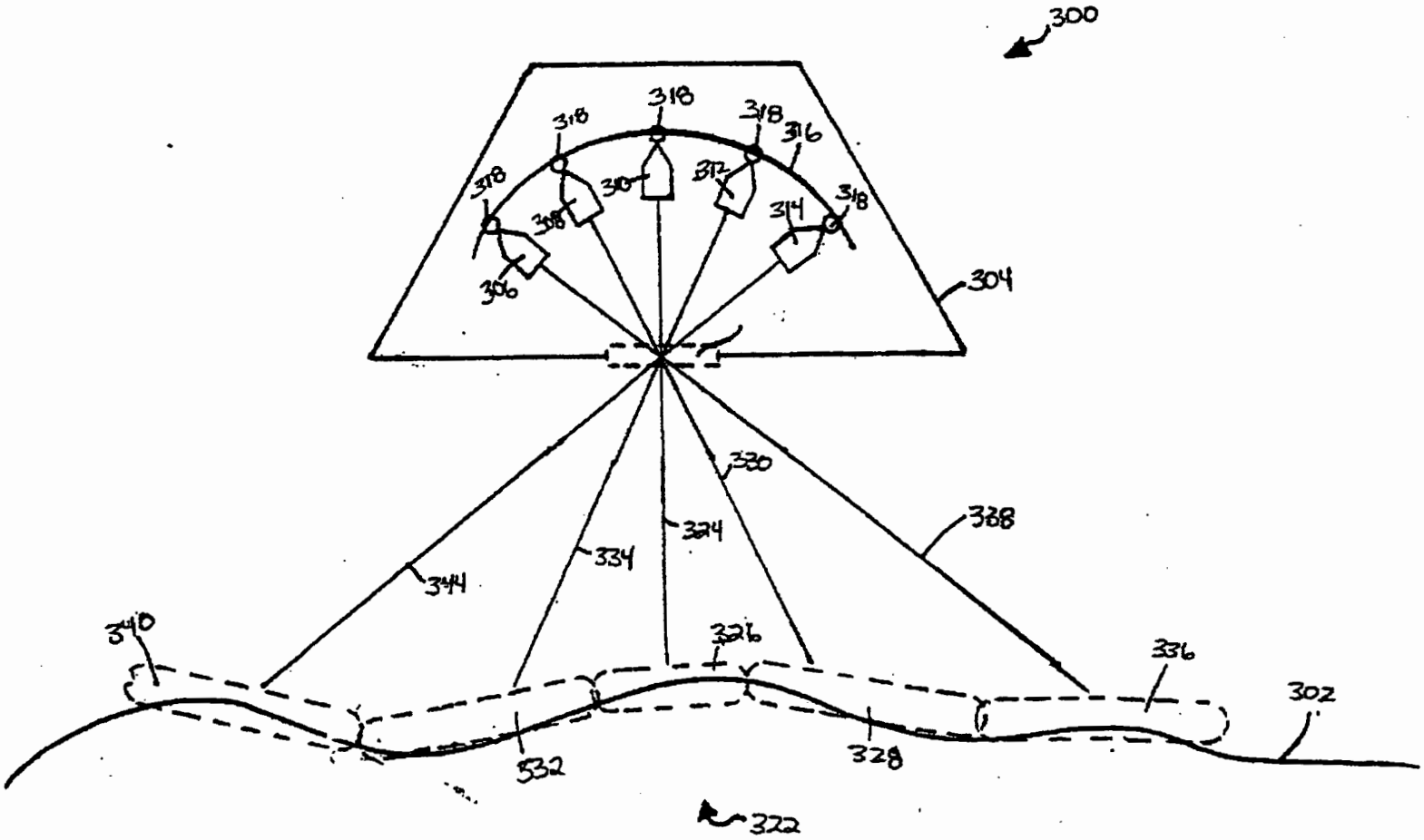


FIG. 3

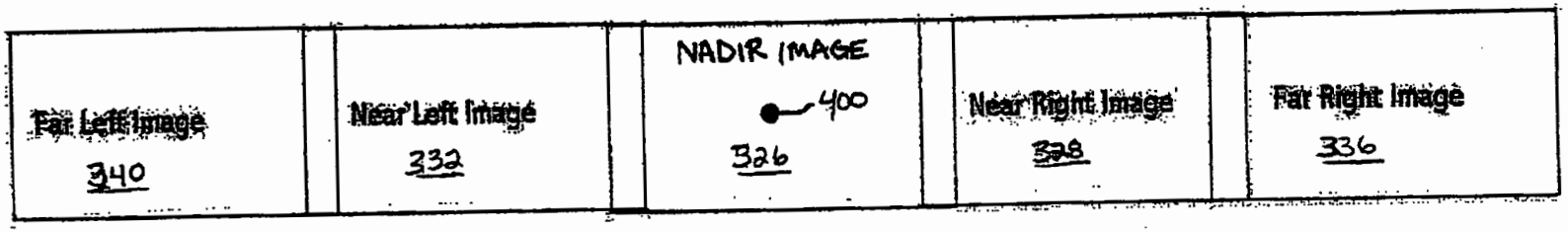


FIG. 4

App. No.: 10/664,737
Reply to Office Action of 12/07/04
Annotated Sheet Showing Changes

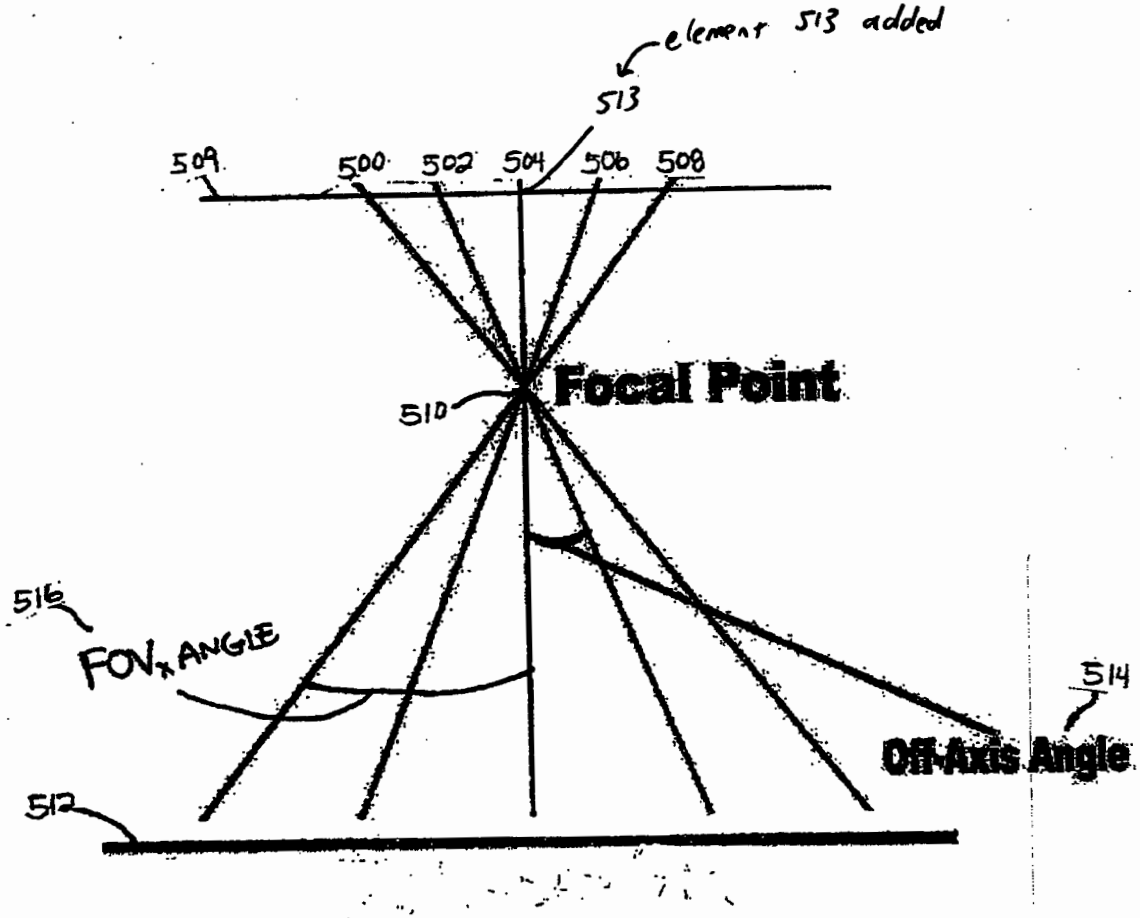


FIG. 5

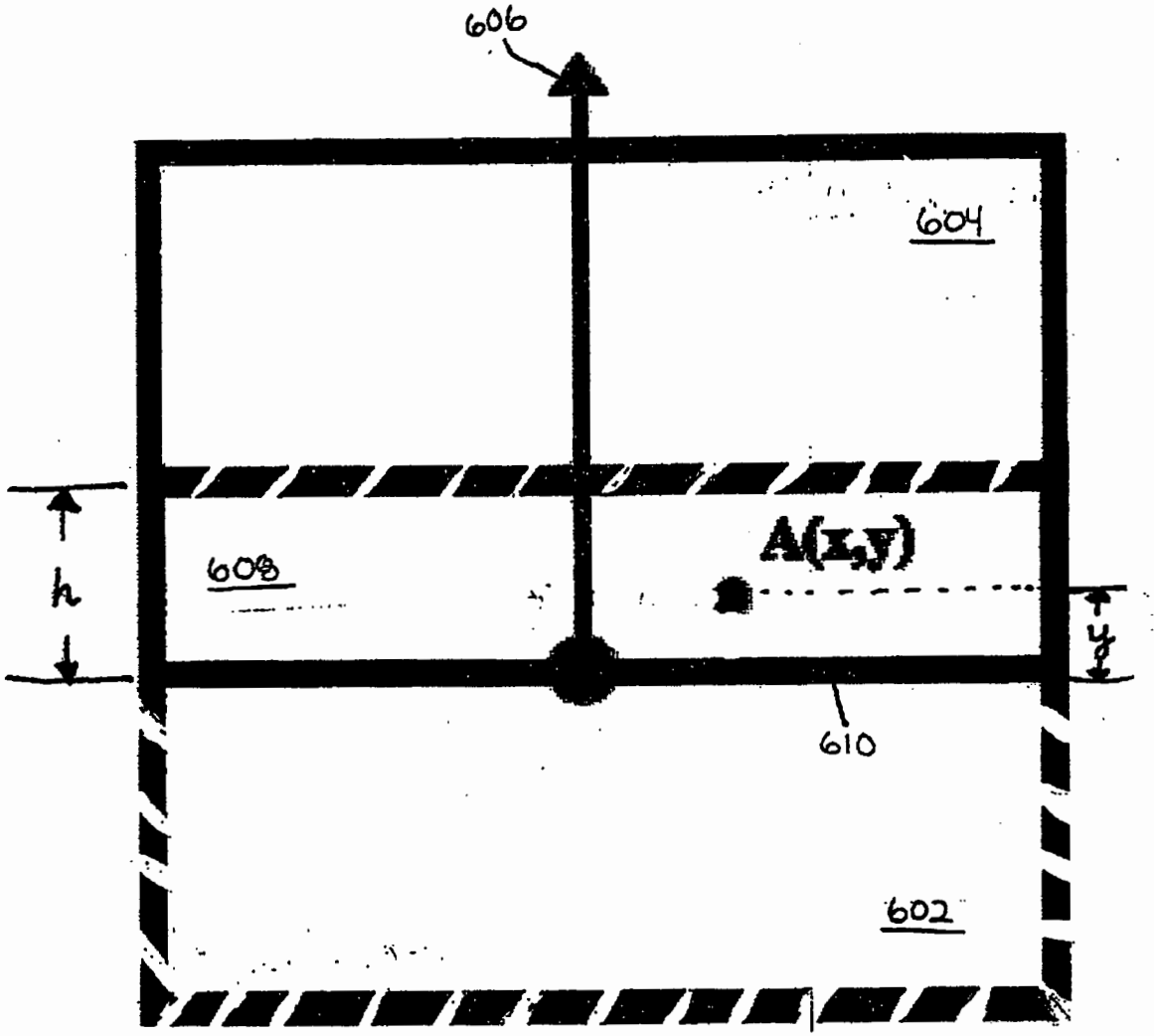


FIG. 6

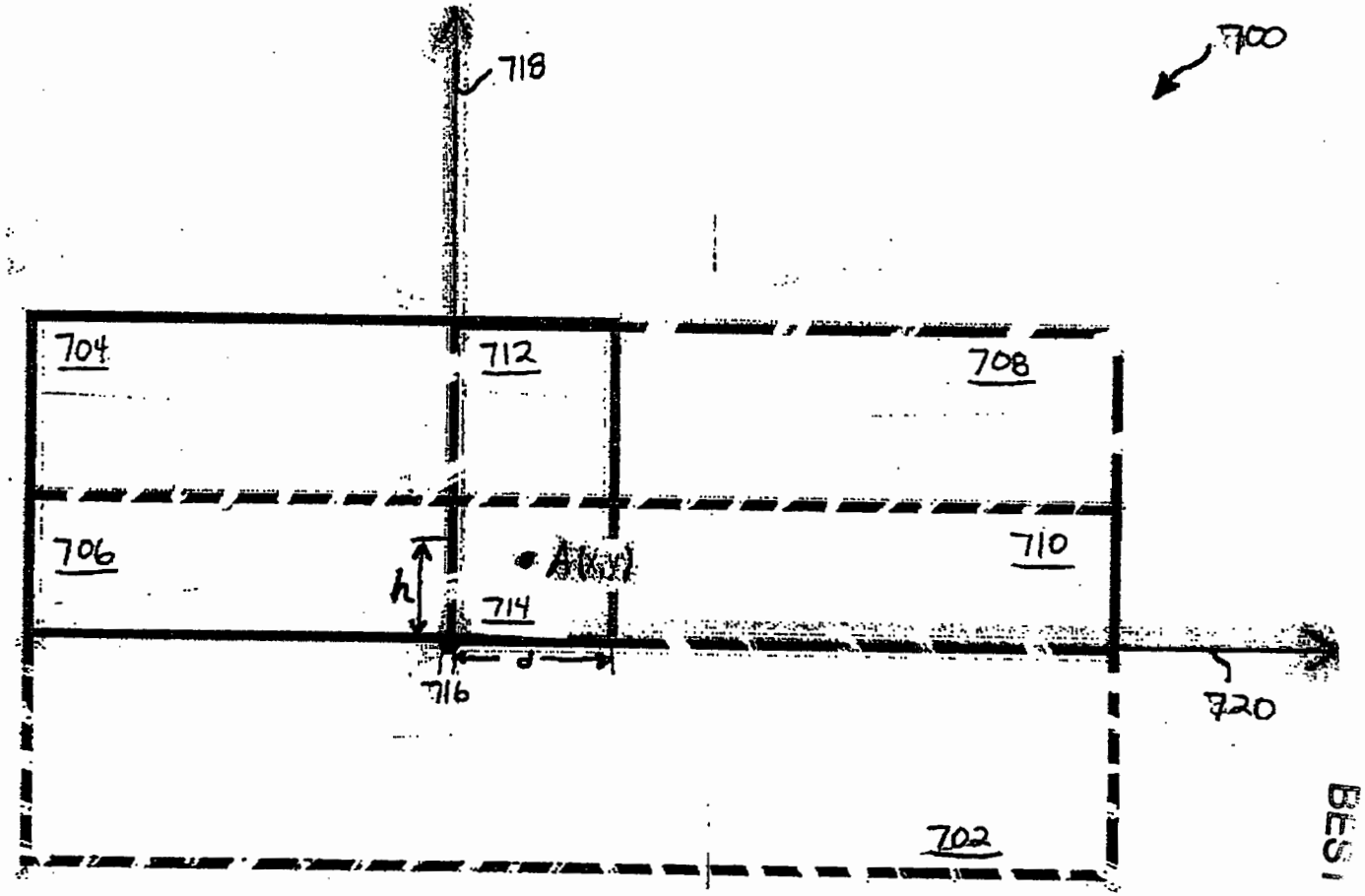


FIG. 7

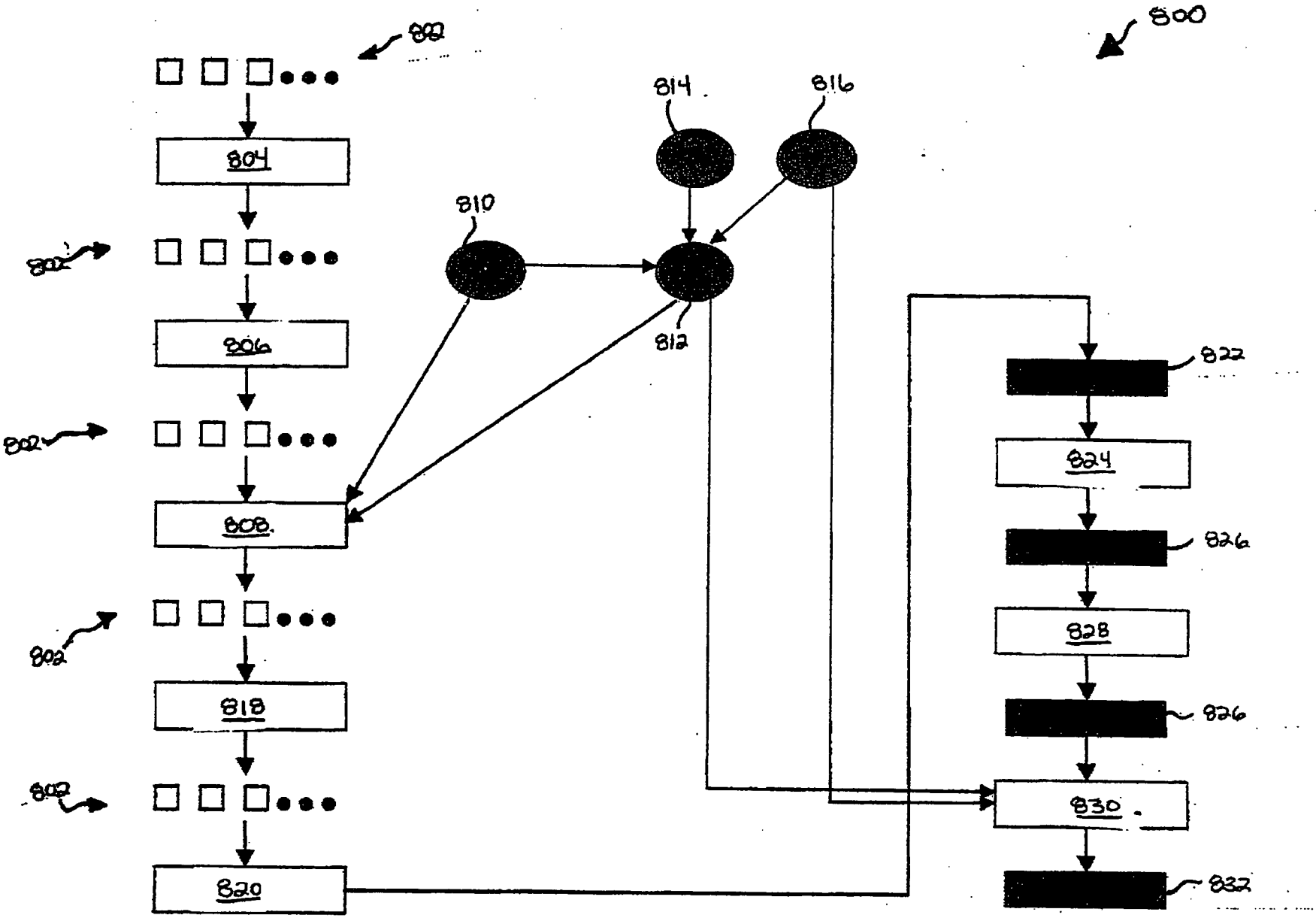
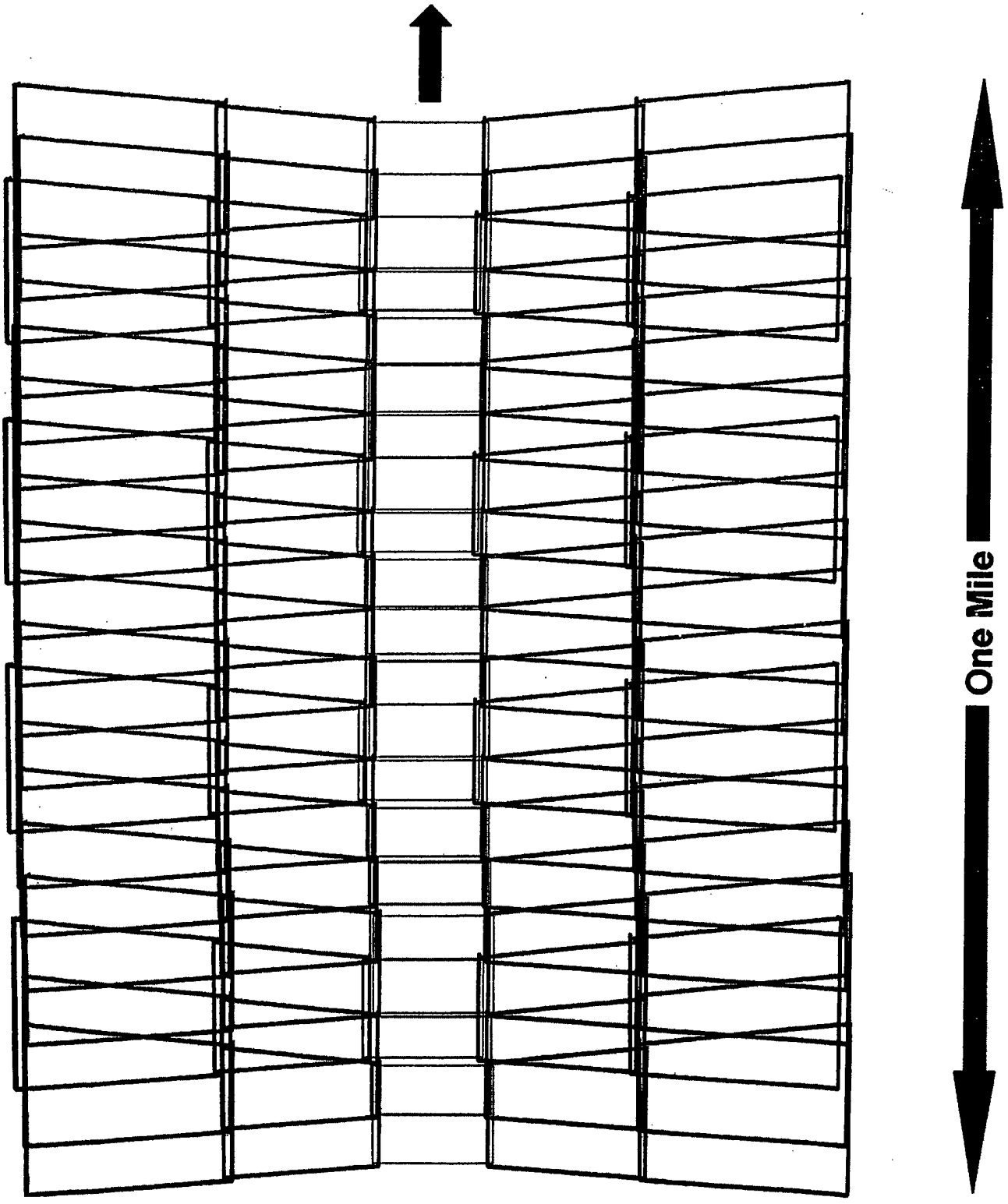


FIG. 8

Figure 9 Photo Pattern Illustration: 1 Flight Mile

Looking down from Aircraft

Five Camera Version Ortho-rectified Data



App. No.: 10/664,737
Reply to Office Action of 12/07/04
Annotated Sheet Showing Changes

FIGURE 10

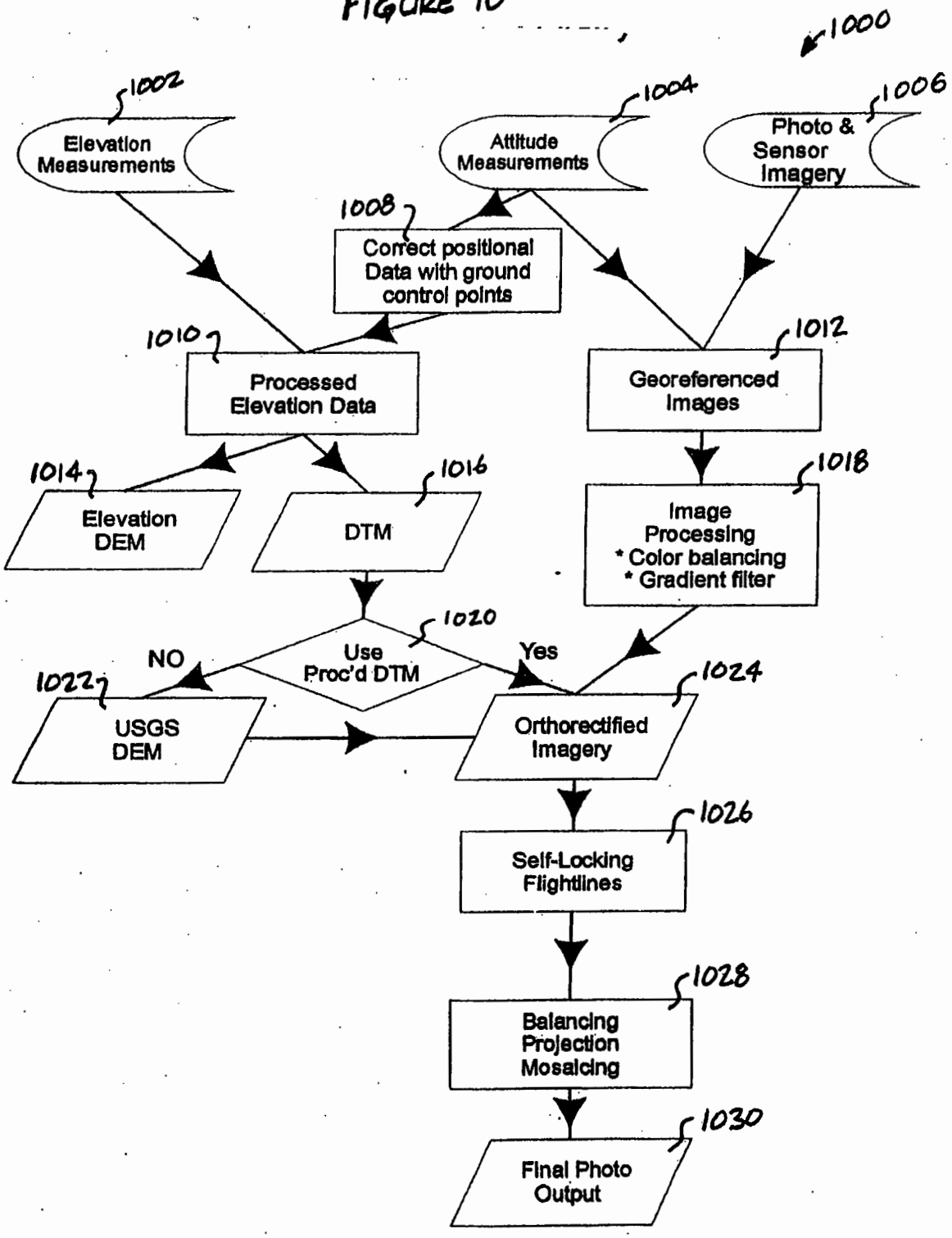


FIGURE 11

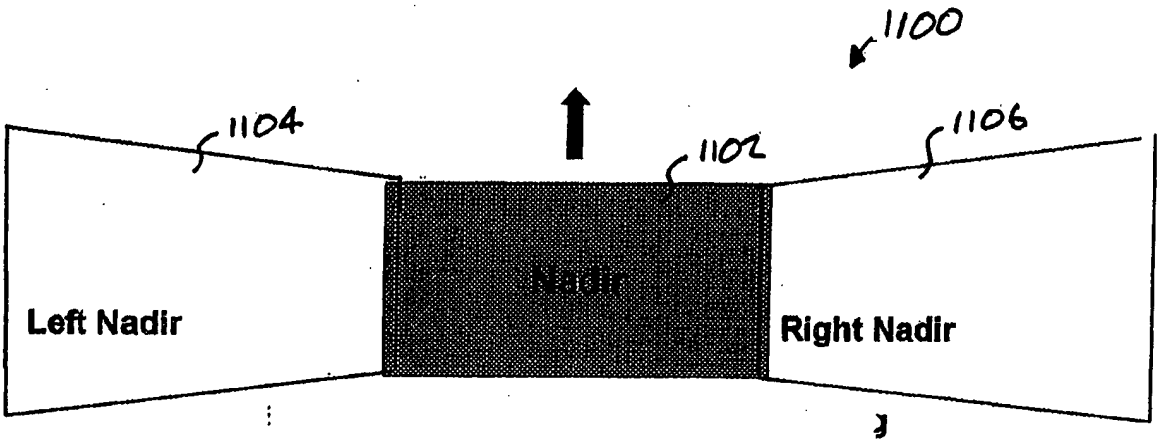
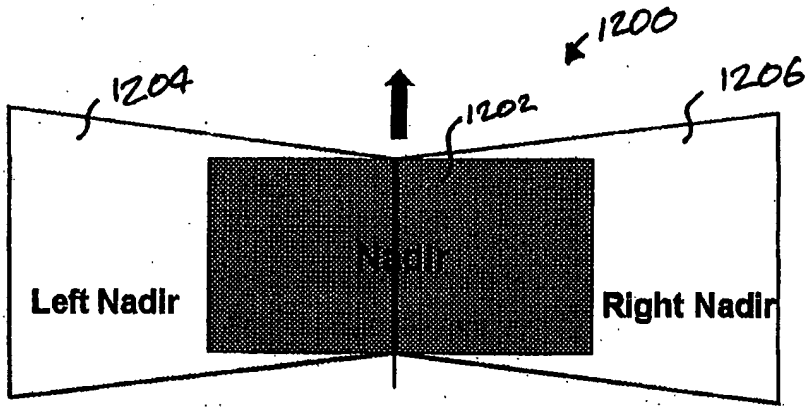


FIGURE 12



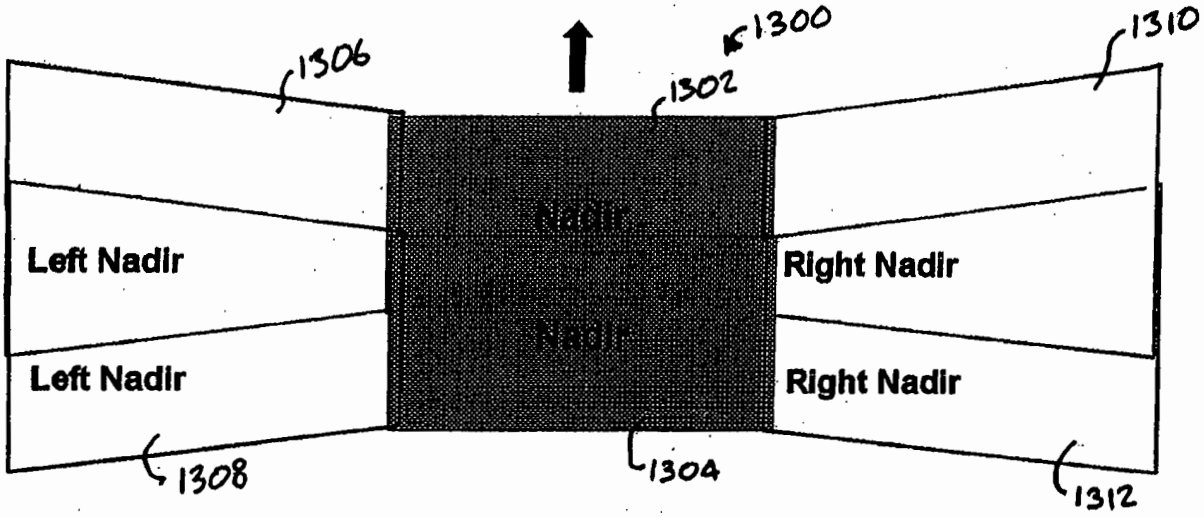


FIGURE 13

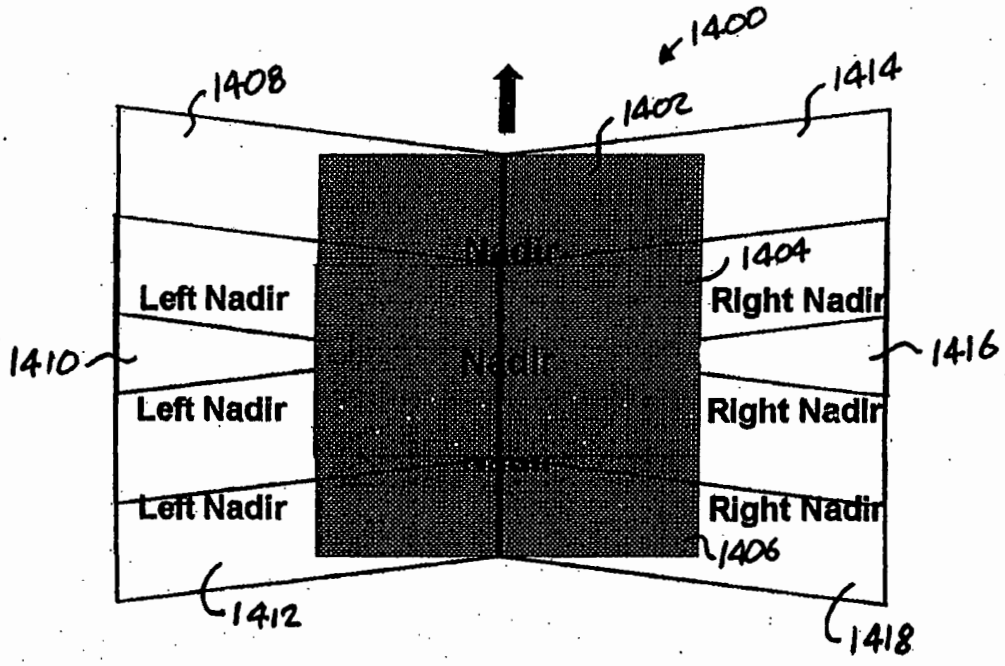


FIGURE 14

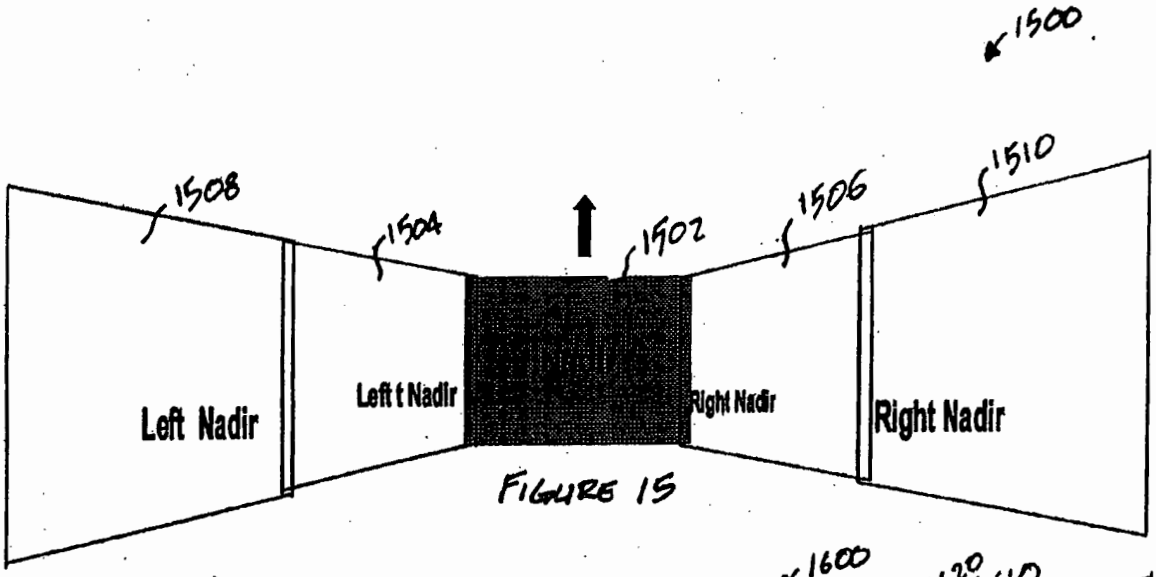


FIGURE 15

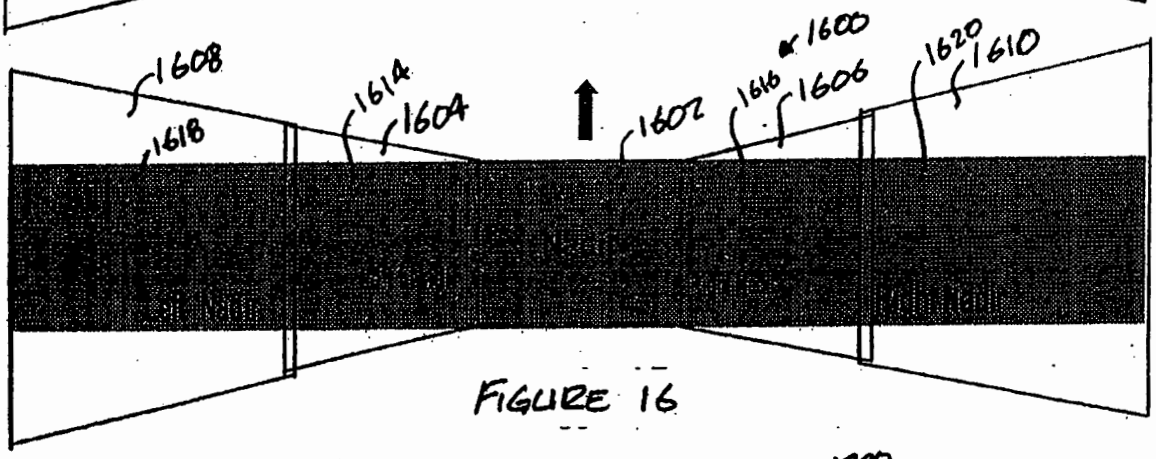


FIGURE 16

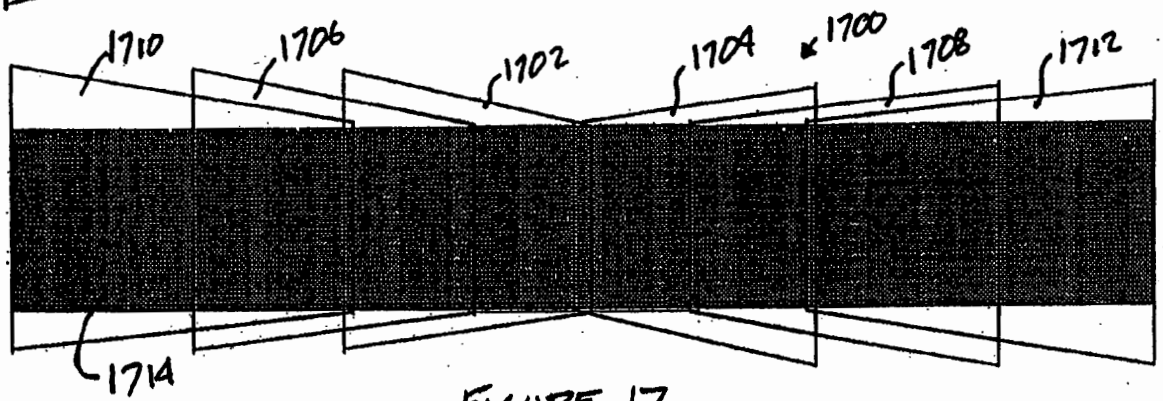


FIGURE 17

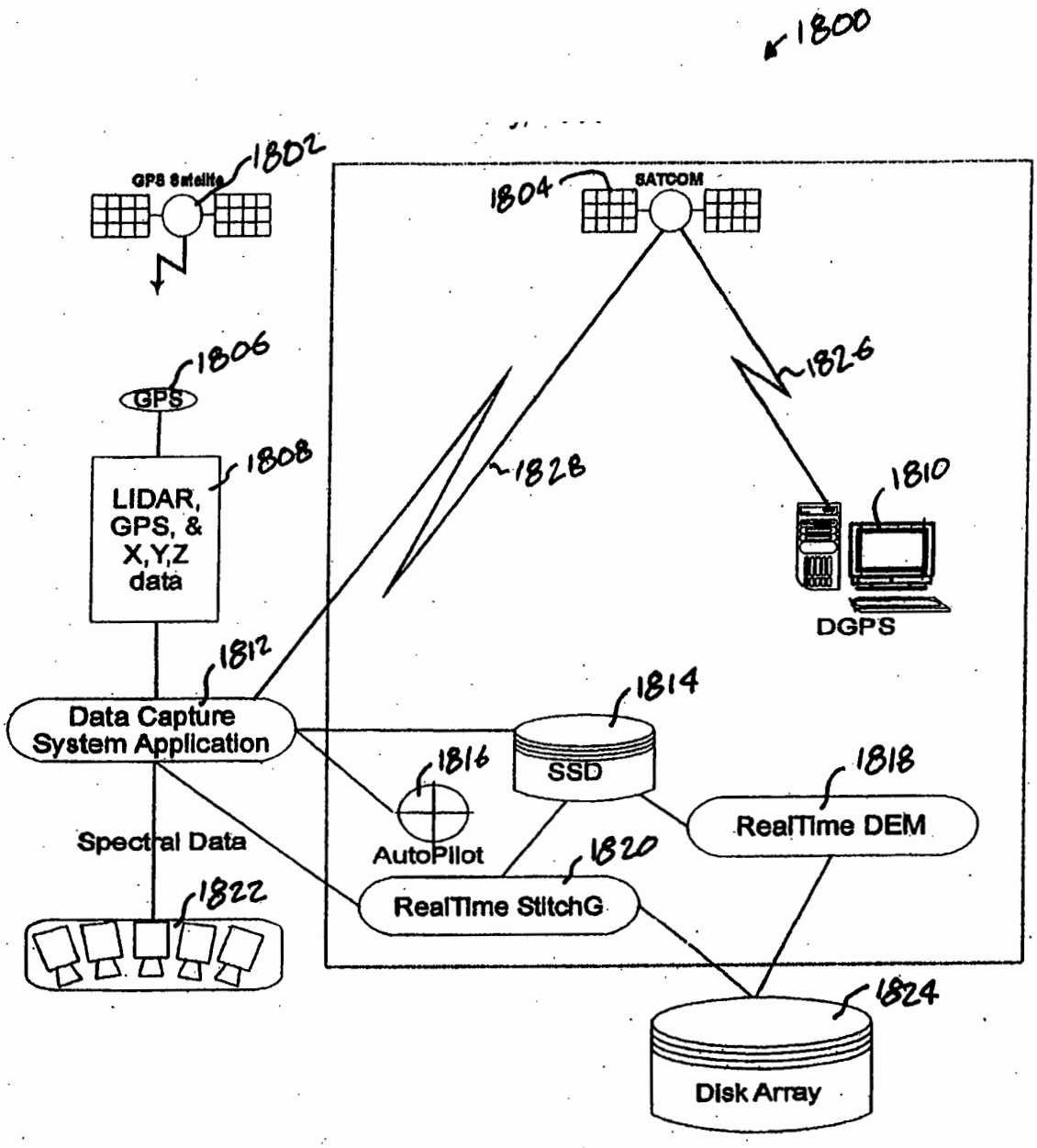


FIGURE 18